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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/567,124	02/06/2006	Miyuki Tsukioka	126928	2903
25944 7590 03/16/2011 OLIFF & BERRIDGE, PLC P.O. BOX 320850 ALEXANDRIA, VA 22320-4850				
EXAMINER				
CLARK, GREGORY D				
ART UNIT		PAPER NUMBER		
1786				
NOTIFICATION DATE		DELIVERY MODE		
03/16/2011		ELECTRONIC		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

OfficeAction25944@oliff.com
jarnstrong@oliff.com

Office Action Summary

Application No.

10/567,124

Applicant(s)

TSUKIOKA ET AL.

Examiner

GREGORY CLARK

Art Unit

1786

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02/08/2011.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,5-7,10 and 13 is/are pending in the application.
- 4a) Of the above claim(s) 3,4,8,9,11 and 12 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,5-7,10 and 13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-946)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

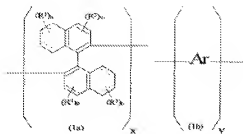
A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 02/08/2011 has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. **Claims 1-2, 6-7, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu (Chemical Materials, Vol. 13, NO. 6, pages 1984-1991) in view of Chen (US 2004/0106003).**
2. **Regarding Claims 1-2**, applicant claims an electroluminescent polymer represented by Formula(s) 1a and 1b:



wherein:

R^1 , R^2 , R^3 , and R^4 are each independently hydrogen, alkyl, alkenyl, alkynyl, aralkyl, aryl, heteroaryl, alkoxy, aryloxy, or aliphatic heterocyclic group;

the double bonds of the bis(arylethynyl) structural unit indicated by dashed lines and solid lines are each an unsaturated double bond or a saturated single bond;

m and p are each independently 0, 1, or 2;

n and o are each independently 0, 1, 2, 3, 4, 5, 6, 7, or 8;

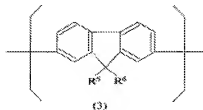
when m , n , o , or p is an integer of 2 or greater, the two or more R^1 's, R^2 's, R^3 's, or R^4 's may or may not be identical to one another;

x is in a range of from 5 to 50 mol%;

y is the molar fraction of the aryl structural units;

y is in a range of 50 to 95 mol%, and

Ar is an aryl structural unit that can form an electroluminescent π -conjugated polymer, the aryl structural unit being a fluorene derivative structural unit represented by formula (3):

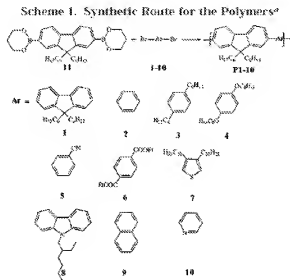


where R^5 and R^6 are each independently hydrogen, alkyl, alkenyl, alkynyl, aralkyl, aryl, heteroaryl, alkoxy, aryloxy, or aliphatic heterocyclic group.

Liu discloses alternating polyfluorene copolymers with different main chain aromatic (phenylene) structures attached at the 2 and 5 positions synthesized by a

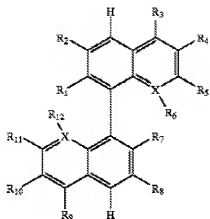
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palladium-catalyzed Suzuki coupling reaction (abstract). Scheme 1 shows the synthetic route to the polymers:

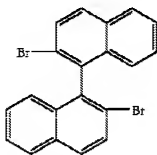


Liu further mentions that copolymerization of fluorene with various aryl partners allows for tunability of the electronic properties with enhanced stability (page 1985). Liu shows a number of reactive aromatic species (Br-Ar-Br) including naphthyl species 10 but fails to mention the binaphthylene species claimed by applicant.

Chen discloses a binaphthylene derivative that is reactive by a palladium-catalyzed Suzuki coupling reaction (paragraph 30) which is used to make electroluminescent compounds (paragraph 30) represented by Formula C-1 (paragraph 21):



wherein X can be a carbon atom; R₆ and R₁₂ can be substituted by aromatic compounds (paragraph 22). R₁-R₁₂ can be hydrogen, alkyl or aromatic (paragraph 11). Formula C-1 as a reactive species can be represented by Formula C-2 (paragraph 44):



Chen further mentions that an advantage for using a binaphthylene derivative in an organic electroluminescent device (OLED) is that close molecular packing is prevented due to the large dihedral angle between the two naphthyl groups. When close molecular packing is prevented, the resulting OLED shows high photo and electro-luminescent efficiency (paragraph 9).

Formula C-2 by Chen represents an aromatic dibromide species which is used in analogous manner to the reactive aromatic species Br-Ar-Br of Liu (above). The

aromatic species (Br-Ar-Br) of Liu and Formula C-2 of Chen are components used to make materials used in OLED. As Liu teaches that incorporating dinaphthyl derivatives prevents close molecular packing resulting OLED shows high photo and electro-luminescent efficiency, one could envisage replacing a Br-Ar-Br species from Liu with Formula C-2 of Chen to make a polymer with improved photo and electro-luminescent efficiency.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have selected from known Suzuki reactive Br-Ar-Br species which would have included Formula C-2 of Liu which reads on the instant limitations since Liu teaches that incorporating dinaphthyl derivatives prevents close molecular packing resulting OLED shows high photo and electro-luminescent efficiency, absent unexpected results.

Liu and Chen fail to mention the molar fraction of the dinaphthyl derivative (x) and the fluorene derivative (y). Applicant claims 50-95 mol% and 50-95 mol%.

As Chen teaches that the dinaphthyl derivative prevents close molecular packing resulting in an OLED that shows high photo and electro-luminescent efficiency, the molar fractions of copolymers containing a dinaphthyl derivative (x) and a fluorene derivative (y) is viewed as a cause effective variable to optimize the photo and electro-luminescent efficiency. In cases where the dinaphthyl derivative (x) fraction was too low, the luminescent efficiency would be decreased.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have adjusted the molar fraction of the dinaphthyl derivative (x) and the

fluorene derivative (y) to optimize the photo and electro-luminescent efficiency which would have included the claimed ranges, absent unexpected results.

3. **Regarding Claims 6-7, 10**, Liu in view of Chen teaches the invention of claims 1-2 (discussed above).

Chen discloses an electroluminescent device containing a luminescent layer composed of a dinaphthyl derivative between two electrodes (paragraph 10) (per claims 6 and 10). Chen discloses that electroluminescent device can be used in a display (paragraph 4) (per claim 7).

4. **Claims 5 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu (Chemical Materials, Vol. 13, NO. 6, pages 1984-1991) in view of Chen (US 2004/0106003) as evidenced by Pielichowski (Progress in Polymer, 2003, Vol. 28, pages 1297-1353).**

5. **Regarding Claim 5**, Liu in view of Chen disclose the invention of claim 1. The copolymer composed of the dinaphthyl derivative (x) and the fluorene derivative (y). Formula C-1 (above) shows a dinaphthyl derivative where m is 2, p is 2, n is 3 and o is 3. Applicant claims that m, n, o or p is an integer of 2 or greater.

Liu discloses that the electronic properties of the conjugated polymer are primarily governed by the chemical structure of the backbone itself. One way to achieve high efficiency in a polymer electroluminescent device (PLED) is to develop materials

that have charge transporting properties (page 1985). Liu shows in Scheme 1 (above) carbazole derivative 8 but fails to mention a terpolymer of identify carbazole derivative 8 as a charge transporting material.

Pielichowski discloses carbazole containing polymers as charge transporting materials (page 1298) used in an electroluminescent device (abstract).

As Liu mentions that the electronic properties of the conjugated polymer is primarily governed by the chemical structure of the backbone and shows a charge transporting carbazole derivative 8.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the electroluminescent copolymer of Liu in view of Chen by incorporating a third monomer which would have included the Suzuki carbazole 8 of Liu which read on the instant limitations since Liu teaches that higher efficiency in a polymer electroluminescent device (PLED) can be achieved with the copolymers which also have charge transporting properties.

6. **Regarding Claim 13**, Liu in view of Chen and Pielichowski teaches the invention of claim 5 (discussed above). Chen discloses an electroluminescent device containing a luminescent layer composed of a dinaphthyl derivative between two electrodes (paragraph 10).

Response to Arguments/Amendments

Applicant argues that neither Lui nor Chen teach the x mol fraction or the y mol fraction and the x and y ranges are critical ranges that would not have been obvious to achieve through optimization.

The examiner counters that the unique properties binaphthyl group was known in the art at the time of the invention. Chen discloses that the large dihedral angle between the naphthyl groups ensures a high degree of stereo-selectivity and results in non coplaner binaphthyl unit (paragraph 9). The examiner views the large dihedral angle between the naphthyl groups as equivalent to the applicants' "a polymer that has bends". Moreover, Chen discloses teaches that the binaphthyl unit is responsible for high photo and electro-luminescent efficiency.

A skilled artisan would have adjusted the ratio of the x and y components to achieve an optimized luminescent efficiency. This process would have involved determine carrying out a series of Suzuki based polymerizations each with a different ratio components x and y. Each copolymer would be used in an organic layer between two electrodes and the resulting device would have been subjected to a voltage. The luminescence of each device would be measured to determine which ratio resulted in the most efficient luminescence which would have included the claimed ranges. As the prior art does not teach away from a specific range, applicants' claimed ranges would have been included in the optimization process.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GREGORY CLARK whose telephone number is (571)270-7087. The examiner can normally be reached on M-Th 7:00 AM to 5 PM Alternating Fri 7:30 AM to 4 PM and Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Larry Tarazano can be reached on (571) 272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/D. Lawrence Tarazano/
Supervisory Patent Examiner, Art Unit 1786

GREGORY CLARK /GDC/
Examiner
Art Unit 1786

